NOVEMBER/DECEMBER 2023

# DCH33/GCH33 — PHYSICAL CHEMISTRY - III

Time : Three hours

Maximum : 75 marks

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## SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Define concentration over potential.

2. What is meant by symmetry factor?

3. What do you mean by diamagnetic anisotropy?

4. What are color centres? Name various types of colour centres.

5. How many fundamental vibrational frequencies are expected for the following molecules?

   (a) $CO_2$

   (b) $CH_4$

6. What are overtones?

7. Define chemical shift.

8. What is the nuclear spin I of the following nuclei?

   $^{2}D$, $^{1}H$, $^{19}F$.

9. Mention four phenomena that cannot be explained by Maxwell-Boltzmann statistics.

10. Write the expression for the vibrational partition function of diatomic molecules.

## SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Write a note on Pourbiax diagram of iron system.

Or

(b) Describe the construction and working principle of hydrogen fuel cell.

12. (a) Write a short note on different types of point defects in solids.

Or

(b) Explain quantum theory of paramagnetism.

13. (a) Enumerate the effect of anharmonicity on the vibrational spectra of diatomic molecules.

Or

(b) Discuss the Franck-Condon principle.

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14. (a) Give a brief note on Fourier Transformation Resonance Spectroscopy.

Or

(b) Write a note on spin-spin coupling in NMR.

15. (a) Derive Maxwell-Boltzmann distribution law.

Or

(b) Derive the expression for translational partition function of diatomic molecule.

## SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the Butler-Volmer equation for one step and multistep electron transfer reactions.

17. Write notes on piezo electricity and ferro electricity.

18. Discuss the rotational spectrum of a diatomic molecule taking it as a rigid-rotator.

19. (a) Discuss the NMR spectrum of AMX type molecules. (5)

(b) Write a note on Zeeman effect. (5)

20. (a) Derive the equation for Fermi-Dirac distribution function. (5)

(b) Highlight on Stirling's approximation. (5)

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